CIRAS-4 Portable Photosynthesis System

Unrivaled Performance, Portability & Power.

Don't let its compact size fool you. The highly accurate CIRAS-4 Portable Photosynthesis System is a lightning-fast portable powerhouse that will elevate your research experience.

Its advanced software is exceptionally intuitive and customizable. You can manage environmental controls—as well as how you view your data—all from the touchscreen. It's so easy to use, you can begin taking measurements right out of the box.

An exceptional user experience

- **Truly portable!** Lightweight console (4.8 kg with two battery packs or 5.2 kg with three battery packs) and leaf cuvette (0.7 kg)
- Large, full color touch display. Advanced touch navigation for all system operations.
- Adjustable display brightness. Easily controlled backlight system with exceptionally bright LEDs for sunlight readability in any condition.
- Fully automatic, independent, and programmable control of CO₂, H₂O, temperature, and light.
- 32 GB of memory.
- Quick and easy file transfer.
- All accessories are plug and play!
- Versatility at it's best. Multiple lightweight, field-ready accessories are available for use with the CIRAS-4 for several applications.





Unrivaled performance

- **True differential gas analyzer** featuring four independent, non-dispersive infrared gas analyzers for both CO₂ and H₂O.
- Small system volume optimized for the fastest, most accurate measurement of photosynthesis available.

Packed with power

- Up to 16 hours of continuous operation. Two high-capacity Li-ion battery packs and an optional, easily interchangeable third Li-ion battery pack makes for uninterrupted, long operation time. All three battery packs can charge simultaneously from the CIRAS-4 power supply adapter/charger.
- View individual battery pack status from the exterior of the console as well as on the display screen.



Side view of CIRAS-4 showing battery power status from the exterior of the console.

Elevate your research experience.

Easy-to-use software that's highly customizable!

- **Highly advanced user interface.** Includes intuitive navigation, enhanced graphics, and lightning-fast response.
- Fastest, simplest rapid A/C_i curves available. Our CO₂ ramping process is built right into the software for easy setup and processing of rapid measurement of A/C_i based on both upward and downward ramps.
- Full virtual QWERTY keyboard and numeric keypad allowing users to enter both alpha-numeric data and environmental controls.
- Multiple-user friendly. Set up to eight unique profiles based on application, operator, and/or experiment.
- Comments are quick and easy to include with data files.
- Built-in help files. Got a question? The answer is right at your fingertips.
- **Configure your own stability criteria** to let you and the system know when to trigger a measurement.
- Graph up to six parameters at a time including zoom, pause, and resume, and customization of the X and Y axis for each parameter is quick and easy.



Rugged leaf cuvettes & light units designed for high-level field measurements

- No tools required to change head plates. Head plates are secured in place by magnets for quick and easy change out in the lab or field.
- Minimal boundary layer resistance. Advanced air mixing inside the chamber reduces boundary layer resistance.
- Precise and accurate temperature control.
- Easy and accurate leak diagnosis. Direct pressure measurement inside cuvette for easy and accurate leak diagnosis.

PLC4 Broad/Narrow/Conifer Leaf Cuvette

Three interchangeable heads. For measurement on large, flat broad leaves, narrow leaves, and grasses and conifers.



Shown left to right: PLC4 Broad, Narrow, and Conifer Leaf Cuvettes

PLC4 LED Light Units (RGBW-FR)

- Four far-red LEDs with light intensity up to 30% of PAR.
- Automatic control. Automatically control light intensity (0-2500 µmol m⁻² s⁻¹) and ratio of red/green/blue/white LEDs.



Field-friendly and easy to use! Our PLC4 Light Units are easy to attach and disconnect from the leaf cuvette head.

PLC4 Universal Cuvette

A Read

The PLC4 comes with three interchangeable head plates and is compatible with the CFM-4 Chlorophyll Fluorescence Module for simultaneous measurement of leaf gas exchange and chlorophyll fluorescence.

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External PAR Sensor With industry standard calibration & cosine correction

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Rulers on Apertures For accurate estimation of leaf area

Quick Release Tab Easily open the leaf cuvette head when closed

CFM-4 Chlorophyll Fluorescence Module

- **OJIP fast induction kinetics.** The CFM-4 provides OJIP fast induction kinetics as well as multiple additional relevant chlorophyll fluorescence parameters.
- Improved fluorescence detector module provides high frequency measurements with optimized signal-to-noise ratio.
- Easily store and export OJIP related data points for further analysis to provide many additional fluorescence-related calculations.
- Provides both dark-adapted and light-adapted chlorophyll fluorescence measurement parameters.
- Automatic control. Includes standard LED light unit for automatic control of light intensity (0-2500 μmol m⁻² s⁻¹), ratio of red/green/blue/white LEDs, and far-red (0-30% of PAR).

CFM-4 Chlorophyll Fluorescence Module shown on the PLC4 Universal Leaf Cuvette

Technical Specifications

CIRAS-4 Portable CO₂/H₂O Gas Analysis System

Analysis Method

Non-dispersive infrared, configured as an absolute absorptiometer with microprocessor control of linearization. Four independent gas analyzers simultaneously measure absolute CO_2 and H_2O for both the reference and analysis gas streams. All measurements ARE corrected for temperature and pressure.

CO ₂ Measurement Range Co ₂ Accuracy	0 – 10000 μ mol mol ⁻¹ (Optimized for 0-2000 μ mol mol ⁻¹) ± 3 μ mol mol ⁻¹ at 300 μ mol mol ⁻¹ Within 1% of reading > 300 μ mol mol ⁻¹	USB Flash Drive	Two USB flash drive ports for transferring stored data files, response curve scripts, and updating system firmware and software.
CO ₂ Precision	0.1 µmol mol ⁻¹	Internal Memory	32 GB
CO ₂ Control Range	0 – 2000 μmol mol ⁻¹	Microprocessor	528 MHz ARM [®] Cortex™
H ₂ O Measurement Range	0 – 75 mmol mol ⁻¹	Touch Display	7.0" capacitive touch LCD display (800 x 480 pixels). Sunlight readable.
H ₂ O Accuracy	± 0.08 mmol mol ⁻¹ up to 5 mmol mol ⁻¹ Within 1.5% of reading > 5 mmol mol ⁻¹	Power Supply	Two internal, rechargeable 7.2V Li-ion battery packs (Primary) provide up to 16 hours of continuous use. An
H ₂ O Precision	0.01 mmol mol ⁻¹		optional, interchangeable third
H ₂ O Control Range	0-Dewpoint or 0-100% Ambient		battery (Reserve) can simultaneously
Pressure Range	55 – 115 kPa		extend operation time in the field.
Air Sampling	User-adjustable from 50 – 100 cc min ⁻¹ using integral DC pumps. Both analysis and reference pumps are fitted with mass flow controllers.	Operating Temperature Range	-5 to 50 °C, non-condensing. External air filtration may be required in dusty environments.
Cuvette Air Supply Unit (Integral)	0 – 500 cc min ⁻¹ measured and controlled by a mass flow meter.	Enclosure	Rugged, ergonomic, lightweight aluminum with polyurethane base.
Auxiliary Port	For connection to the SRC-2 Soil	Dimensions	28 cm (W) x 14.5 cm (D) x 24 cm (H)
,	Respiration Chamber and CPY-5 Canopy Assimilation Chamber.	Weight	4.8 kg (including 2 battery packs) 5.2 kg (including 3 battery packs)

PLC4 Leaf Cuvettes

Construction	Handle: AluminumLeaf Gasket: Closed cell foam	PAR Sensor (External)	Filtered silicon cell quantum sensor (cosine corrected).
LCD Display	2 x 16 character display		• Response: 400 – 700 nm
Keypad	2 tactile keys for recording and parameter selection.		 Accuracy: ± 5 μmol m⁻² s⁻¹ Precision: 1 μmol m⁻² s⁻¹
PAR Sensors (Internal)	2 silicon photodiode sensors. • Range: 0 – 3000 µmol m ⁻² s ⁻¹ • Precision: 1 µmol m ⁻² s ⁻¹ For use with LED light unit	Air Temperature Sensor	Precision thermistor • Range: -10 to 50 °C • Accuracy: ± 0.5 °C at 25 °C
Leaf Temperature Sensor Accuracy	± 0.5 °C at 25 °C	Temperature Control	 12 °C below ambient to 15 °C above ambient. Control limits: 0 - 45 °C Setpoint resolution: 0.1 °C
	Universal	Broad / Narrow	/ Conifer
Cuvette Stirring	Air mixing fan	Two miniature air m	ixing fans
Window	Glass	 Broad / Narrow: Conifer: 	Glass Scratch resistant glass
Apertures	 25 mm x 7 mm (1.75 cm²) 25 x 18 mm (4.5 cm²) 18 mm Diameter (2.5 cm²) 	Broad:Narrow:Conifer:	30 mm x 30 mm (9 cm ²) 86 mm x 37 mm (32 cm ²) 76 mm x 37 mm
Leaf Temperature Sensor Type	Infrared sensor for accurate, non-contact measurement.	Precision thermistor • Range:	r -10 to 50 °C
Dimensions	27.5 cm (L) x 3.75 cm (Handle Diameter) Head: 4.5 cm (L) x 4.5 cm (W) x 2.3 cm (H)	27.5 cm (L) x 3.75 cn Head: <i>Broad/Narrow</i> <i>Conifer:</i>	n (Handle Diameter) v: 6.0 cm (L) x 10.9 cm (W) x 2.5 cm (H) 6.0 cm (L) x 10.9 cm (W) x 5.0 cm (H)

Weight 0.7 kg (not including cable)

PLC4 LED Light Units (RGBW-FR)

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Automatic Control	0 – 2500 µmol m ⁻² s ⁻¹		
LED Specification	Wavelength (RGBW)		
	Color	Peak	Full Width at Half Maximum
	Red	625 nm (± 5 nm)	15 nm
	Green	528 nm (± 8 nm)	40 nm
	Blue	475 nm (± 10 nm)	28 nm
	White	425 – 700 nm	
	Far-Red	730 nm (± 5 nm)	31 nm
	Universal		Broad / Narrow / Conifer
Dimensions	6.4 cm (L) x 6	6.0 cm (W) x 5.1 (H)	6.5 cm (L) x 11.2 cm (W) x 6.0 cm (H)
Weight	0.2 kg		0.4 kg

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0.9 kg (not including cable)

SRC-2 Soil Respiration Chamber

Construction	Rugged PVC with a convenient handle for placement on the soil surface.	
Soil Ring	Aluminum. Provides good seal directly on soil or on soil collars (available from PP Systems)	
Volume	1171 ml	
Area	77.6 cm ²	
Cable Length	1.5 m	
Temperature Sensor	Precision thermistor • Range: -10 to 50 °C • Accuracy: ± 0.5 °C at 25 °C	
Dimensions	150 mm (H) x 100 mm (Diameter)	
Weight	0.9 kg	

CPY-5 Canopy Assimilation Chamber

Construction	Rugged polycarbonate	
Soil Ring	Aluminum. Provides good seal directly on soil or on soil collars (available from PP Systems)	
Area	167 cm ²	
Cable Length	1.5 m	
Temperature Sensor	Precision thermistor • Range: -10 to 50 °C • Accuracy: ± 0.5 °C at 25 °C	
Quantum Sensor	 Filtered, silicon cell sensor (cosine corrected) for PAR. Response: 400 – 700 nm Range: 0 – 3000 µmol m⁻² s⁻¹ Accuracy: ± 5 µmol m⁻² s⁻¹ Precision: 1 µmol m⁻² s⁻¹ 	
Dimensions Weight	145 mm (H) x 146 mm (Diameter) 0.9 kg	

Insect Respiration Chamber

Construction	Clear acrylic
Gas Connections	Barb fittings for connection to 1/8" flexible tubing.
Chamber Volume	33 cm ³ (not including gas tubing)
Dimensions	15.1 cm (Length) x 25 cm (Diameter)
Weight	65 g

CFM-4 Chlorophyll Fluorescence Module

Modulating Beam	625 nm ± 5 nm (Red)
Saturation Light	0 – 10000 µmol m ⁻² s ⁻¹
Far Red Light	730 nm (± 5 nm)
Detector	PIN photodiode with >700 nm filter
Detector Method	Rapid pulse peak tracking
Leaf Area	1.75 cm ² , 2.5 cm ² , and 4.5 cm ²
Dimensions	8 cm (L) x 6 cm (W) x 6.2 cm (H)
Weight	0.3 kg

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